New Products

Subassemblies

IC operation keyed to Hall effect

A magnet-actuated integrated circuit is the heart of a solid state keyboard developed by the Micro Switch division of Honeywell Inc. “To the best of our knowledge, this is the first time that mechanical control of an IC has been accomplished economically in the industry,” says James S. Locke, division general manager and a Honeywell vice president.

Locke emphasizes “economically.” The basic price of the new keyboard is about $100, approximately half that of most electromechanical types. Honeywell hopes to carve out a sizable share of the mushrooming market projected for remote terminals and desk-top computers in the 1970’s. The company has started making the key-boards, and is gearing up for full production starting early in 1969.

Each key on the board has its own IC chip. When a key is depressed, a magnet is lowered around the chip and the circuit is actuated. The only mechanical portions are the key itself and its associated spring mechanism.

The IC was the brainchild of Everett A. Vorthmann of the division’s advanced engineering department and Joseph Maupin of Honeywell’s Solid State Electronics Center in Minneapolis. The circuit includes a Hall generator, a trigger and an amplifier.

Surrounded by field. The circuit’s operation depends on the Hall effect—the development of a voltage between the two edges of a current-carrying metal strip whose faces are perpendicular to a magnetic field. As the key is depressed, the magnetic field surrounds a metallic epitaxial layer on a chip of p-type silicon, which carries a current perpendicular to the field. The Hall voltage is developed in a direction perpendicular to both the current and the field. It is very small—in microvolts; it is amplified, and the amplifier output flips the trigger, which switches the amplifier’s output to the proper lines to represent the binary code for the depressed key.

Four bonded wires connect the terminal of the chip to a lead frame, which is fastened to a single-side, glass epoxy printed-circuit terminal board. A comb, soldered just above the top switch row, provides the jumpers or connections for all of the negative inputs in each column of switches. A second p-c board, for the encoding, is mounted below the terminal board and is two-sided.

One side of the encoding board has two vertical columns of conductors for each key, and the reverse side is made up of 32 horizontal rows of conductors. These, in effect, are two separate grid systems. With 16 possible combinations of a four-bit binary code—four O’s through four 1’s—and each system utilizing a four-bit code, two grid outputs can be combined to yield an eight-bit code.

The net result: a specific eight-bit code for each key.

Because the keyboard was designed to meet the American Standard Code for Information Interchange (ASCII) requirements, two separate codes, one each for the shifted and unshifted modes, are assigned to each key. The codes differ by only a single bit so that
Special linear IC's control the regulator (0.01%/v) and isolate the dual metering circuit (no loading). The ammeter and the 10-turn current control are switched over a 10:1 range for enhanced set-and-read control are switched over a 10:1 range for enhanced set-and-read resolution at the low end.

Recovery is at an amazing 2 µsec per volt (except 4 µsec/V for the 2A-7V model) made possible by a special capacitorless output filter (no unwanted stored energy) that yields a modest 0.02%/v ripple and noise figure.

Typical CC Module showing the slide and plug-in provisions that make it so flexible.

The Kepco CC current sources are FAST, ACCURATE and SMALL. Mount 1, 2, 3 or 6 of them in available housings.

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